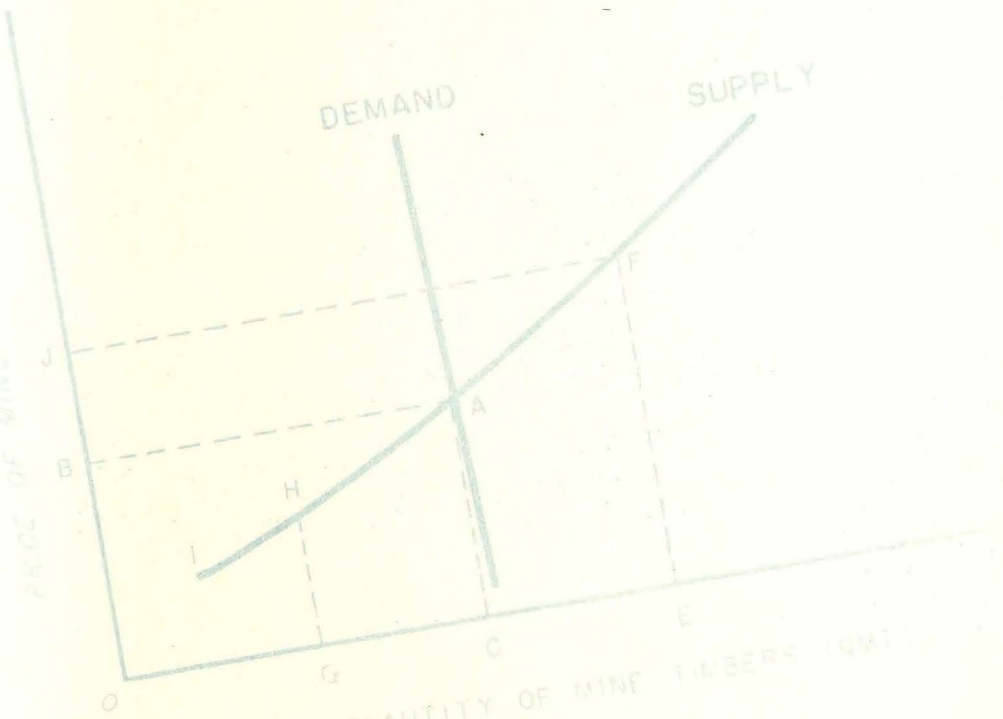
An Economic Analysis Of
MINE-TIMBER MARKETING
In West Virginia

by Henry H. Webster



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An Economic Analysis Of MINE-TIMBER MARKETING In West Virginia

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INTRODUCTION

COAL MINES HAVE long provided a major outlet for the timber products of West Virginia. Although the structure and operation of mine-timber markets is little understood, the efficiency of the marketing system undoubtedly affects the decisions of most of the 130,000 farm and other private timber-growing enterprises in the state.

The author's objective in making this study is to describe and analyze the markets through which these timber products move from the forest to the mine. This involves an examination of both mine-timber supply and mine-timber demand. Supply information is based directly on a field survey carried out by the writer, while an understanding of mine-timber demand rests on more or less ancillary information acquired in the course of this survey. Factual information on mine-timber supply is given in one section, and an

[1]Several West Virginia foresters, notably John F. Tillinghast and D.B. Bonebrake, aided the author in beginning this study. The author also thanks G. Robinson Gregory and Kenneth P. Davis, of the School of Natural Resources, University of Michigan, for analytical and editorial assistance.

analytical treatment of both supply and demand is presented in another. On the basis of this factual and analytical discussion it is possible to answer, at least partially, the following questions:

- Is the West Virginia coal industry experiencing any difficulties in obtaining mine timbers?
- To what extent are mine-timber procurement policies directed toward minimizing present mine-timber costs?
- How and to what extent does assurance of future supplies influence procurement policies?
- What are the principal advantages of present mine-timber marketing arrangements? To whose benefit do they operate?
- Is elimination of middlemen from mine-timber markets a feasible means of increasing returns to forest landowners?
- To what extent does use of high-quality timber in West Virginia coal mines result from deficiencies in mine-timber marketing?

More complete understanding of the factors that affect mine-timber marketing must await coordinated investigation of the marketing of all forest products. Single-product studies of the type reported here leave unanswered many important questions, notably those pertaining to allocation of timber among competing products.

The major reasons for this study are: first, the possible maladjustment in timber-products marketing that is evidenced by the very small income contribution forestry makes in West Virginia; and second, the importance of mine timbers in relation to other timber products.

Before turning specifically to forest income, it is well to note that low incomes are characteristic of much of West Virginia's population. While per capita incomes in 1953 averaged $1,947 in the 12 Northeastern States and $1,709 in the United States as a whole, West Virginians received an average of only $1,257.[2]

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[2]United States Bureau of the Census. Statistical abstract of the United States, 1955. Washington. 1955.

Average gross farm income of all West Virginia farms from the sale of forest products was $27.69 in 1949. This is less than 3 percent of average total farm income even though at the same time forests occupied roughly 40 percent of the total area of West Virginia farms[3] and farm forests comprise one-third of the 10 million acres of commercial forest land in the state (fig. 1). Further, in all but one of the 11 leading coal-producing counties (fig. 2), average gross farm income from sale of forest products was below the state average.

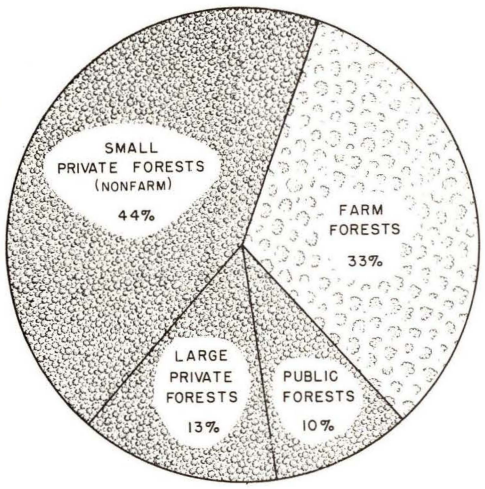


FIGURE 1.--Farm forests comprise one-third of the commercial forest land area in West Virginia.

Even though these statistics do not provide a completely adequate comparison, there is little doubt that forestry's income contribution to farmers is very small. Though no data have been found that summarize forestry's income contribution to non-farm forest landowners, casual observation suggests that the contribution is also small.

Factors that contribute to the present low level of timber income in West Virginia can be grouped in three categories: demand for timber products, supply of timber products, and marketing links between demand and supply.

Supply research (typified by silvicultural studies) is far advanced in comparison with both demand and marketing research, as applied to timber products in West Virginia. No demand studies as such have been undertaken. Existing

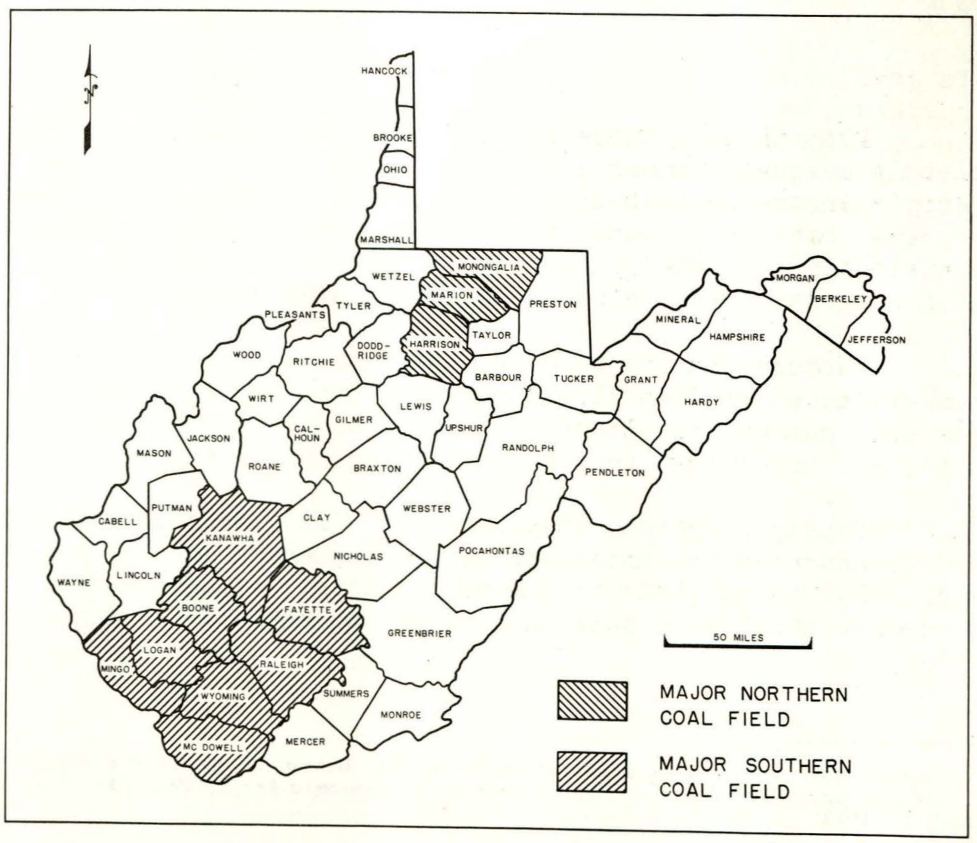
[3] Farm income and area data calculated from U. S. Bureau of the Census, Census of Agriculture 1950, Vol. 1, Counties and State Economic Areas, Part 15. Washington. 1952.

market studies are limited almost entirely to the markets that are directly available to the farm forest owner. Little tracing of products to the ultimate consumer has been done. Partial data of the type obtainable in this study appear to be more useful for arriving at an approximation of reality through marketing studies than through demand studies.

The importance of mine timbers as a component of total West Virginia forest production is suggested by the following factors:

(1) Coal mining is one of the most important segments of the West Virginia economy. Nearly one fourth of all West Virginians employed in non-agricultural industries and covered by unemployment compensation are employed

FIGURE 2.--The major coal-producing counties in West Virginia.



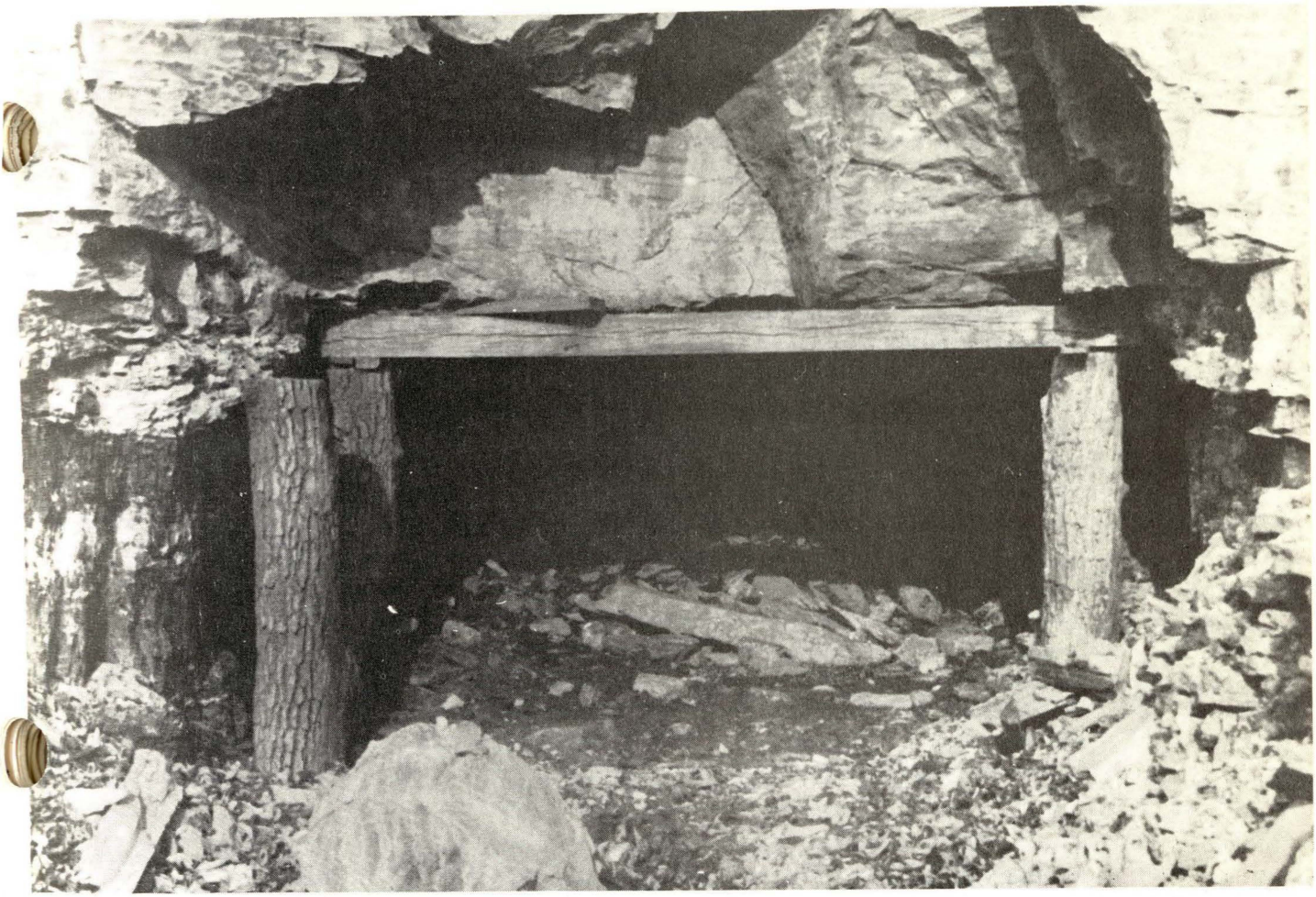


FIGURE 3.--Most of the wood used in coal mining is used for props and headers.

in the coal-mining industry.[4] The coal-mining industry uses a large volume of wood in the form of round and sawed timbers, props and lagging, lumber and ties (fig. 3). In 1948, for example, the volume of timber products used in coal mining equalled approximately half of the total cubic volume of timber cut from West Virginia's forests. Decreased coal production, technological changes reducing the amount of wood used per ton of coal mined, and increased importance of strip mining all suggest that the volume of wood used by this indus-

[4]The Manufacturing Industries of West Virginia. W. Va. Bus. & Econ. Studies 2 (1): 26, table 16. 1952.

try has recently declined. Nevertheless, it is still one of the largest wood-using industries in West Virginia.

(2) Mine-timber markets have a direct and important bearing upon the profitability of forest land ownership in West Virginia. Mine timbers are one use for which relatively low-quality hardwoods are physically suitable. Hardwoods account for 92 percent of the total sawtimber volume on West Virginia's commercial forest land, and nearly two-thirds of this volume is in low-quality standard lumber logs or in tie-and-timber logs.[5] In addition, there is much timber of sawlog size that completely fails to meet minimum sawlog-quality requirements.

(3) Timber physically suitable for utilization as standard factory lumber, commercial veneer, and other high-grade products, and in demand for these uses, is frequently utilized as mine timbers. While there are no quantitative data illustrating this inter-product misallocation of timber, the fact that it is a common observation of numerous West Virginia foresters seems to confirm its existence.

DESCRIPTION OF MINE-TIMBER MARKETS

The findings of a field survey of West Virginia mine timber marketing are reported in this section. Before turning to these findings, however, the author thinks it best to define certain terms and to describe the survey procedures briefly.

DEFINITIONS OF TERMS & FIELD SURVEY METHODS

The term "mine timbers" as used in this study describes all timber products, both round and sawed, that are used in coal-mining operations. As a practical matter, the market mechanisms involved in moving different kinds of round and sawed mine timbers are so tangled that separate treatment did not seem feasible.

Mine-timber price and quantity as used here are relative, in that they refer to directions of change as opposed

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[5] Wray, Robert D. Forest Statistics for West Virginia. U. S. Forest Service Northeast. Forest Expt. Sta., Forest Statis. Ser.: W. Va. 1. 48 pp. 1952.

to absolute levels, and apply to mine timbers as a whole, in contrast to particular types of mine timbers. An exploratory study of mine-timber marketing using absolute prices and absolute quantities applying to particular types of mine timbers would be exceedingly difficult because of a distinct lack of common volume units.

Mine-timber marketing borders at opposite ends upon the operations of forest landowners and coal-mining organizations. Further, it parallels and, in some cases, is coincident with the marketing of other forest products. Interrelationships among these fields--coal mining, forest land ownership, mine-timber marketing, standard lumber marketing, etc.--make a rigidly definitive separation both undesirable and virtually impossible. Nevertheless, an attempt was made in this study to limit consideration of these other fields to that requisite to understanding mine-timber marketing. In fact, the scope of the study ultimately proved too narrow to provide certain sought-for answers.

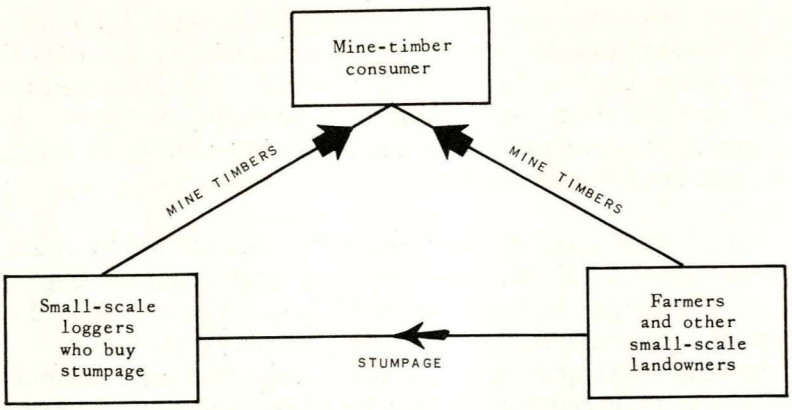
With regard to survey methods, original data were collected in a two-stage interview survey. Mining-organization officials (mostly purchasing agents) were interviewed in the first stage, mine-timber suppliers in the second. The two stages are described below. All interviews were carried out by the writer without formal questionnaires.

First Stage:
Interviews With Mining-Organization Officials

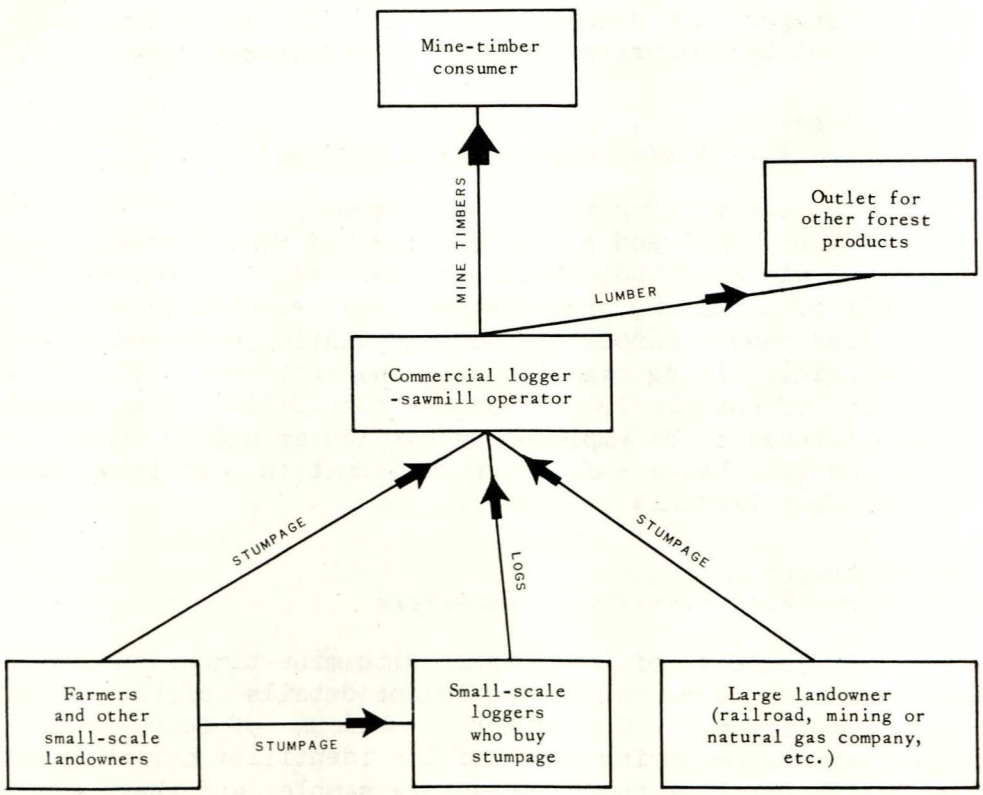
The two major purposes here were: (1) to identify market types employed in the movement of mine timbers, and (2) to obtain some indication of their relative importance. A sample of 34 mining organizations was selected by means of stratified random sampling from a population composed of all West Virginia mining organizations that produced 100,000 or more tons of coal in 1952. Strata were delimited by market types believed to be employed by particular mining organizations on the basis of advance information obtained from several West Virginia foresters.

Second Stage:
Interviews With Mine-Timber Suppliers

The purpose of interviews with mine-timber suppliers was to learn some of the relevant details of the market types identified. One or more (maximum of four) mining organizations employing each of the identified market types were selected from the first-stage sample and their mine-timber procurement was traced to the suppliers who were in direct contact with forest landowners. Sample selection here



A. SMALL-SCALE LOGGER



B. COMMERCIAL LOGGER — SAWMILL OPERATOR

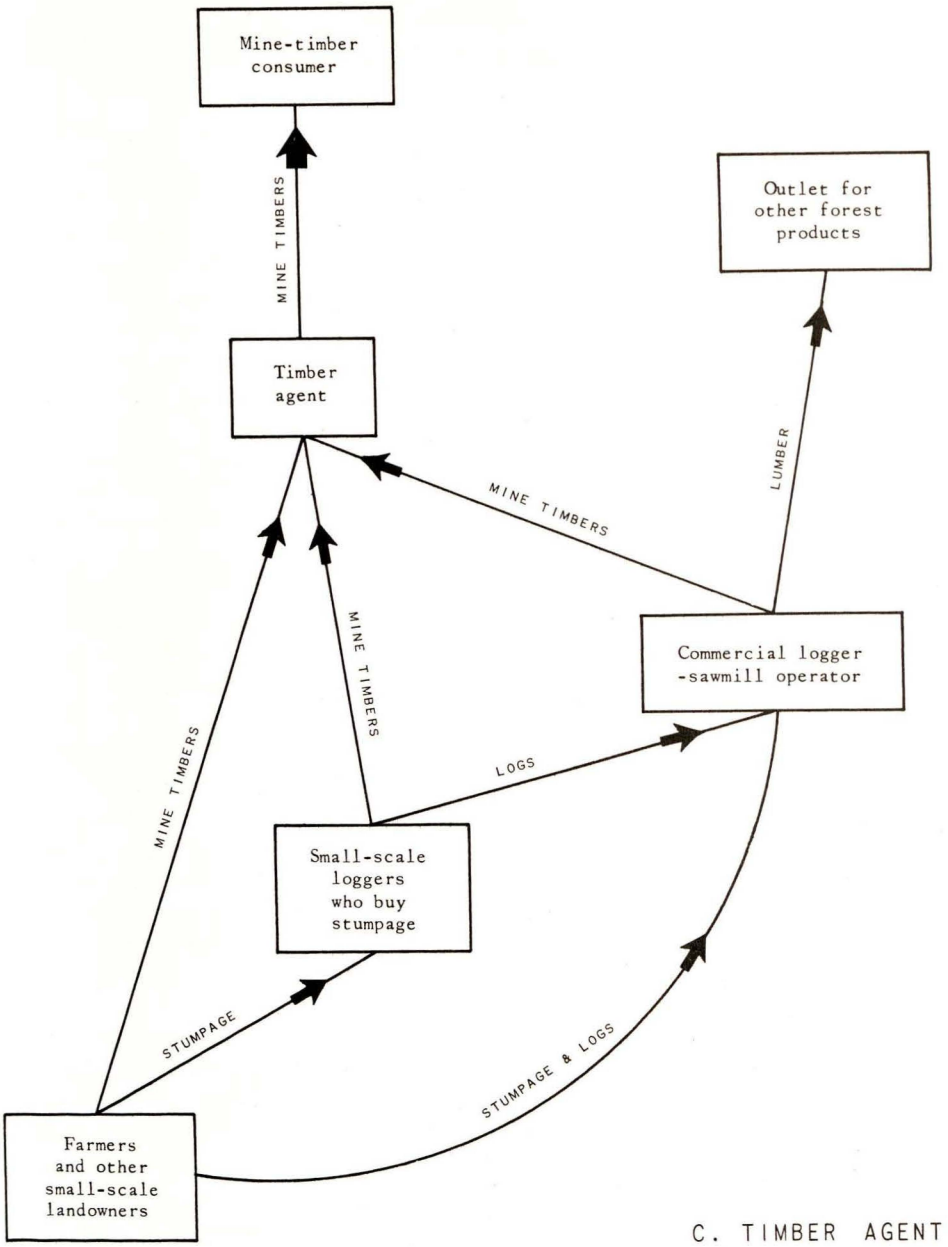


FIGURE 4.--The flow of products in the three general types of mine-timber markets.

was entirely purposive. At least one example of each distinctive type of mine-timber supplier was included.

MARKET DESCRIPTION

Mine-timber markets can be most easily described by considering the principal types of mine-timber suppliers, their characteristics, and their relationships with coal-mining organizations.

Mine-timber suppliers range from farmers who supply a small fraction of the mine timbers used by a single mine, through operators of sizable sawmills, to timber agents who fill a large part, or even the entire requirements, of several large multi-mine organizations. This diversity stems from the unstandardized equipment used to produce mine timbers and the low minimum skill and capital requirements of mine-timber production. Mine timbers can be produced, for example, by a farmer with only an ax and a handsaw, while they may also be produced by well-equipped sawmills.

This more-or-less continuous spectrum of suppliers can be divided into three convenient categories: small-scale loggers, commercial logger-sawmill operators, and timber agents. Small-scale loggers and commercial logger-sawmill operators are, of course, physical timber processors, while timber agents are not. The function of timber agents is to channel mine timbers from processors, particularly from small-scale loggers, to the mines.

Many mining organizations purchase mine timbers from suppliers who fall in several of these categories. Nevertheless, market types defined in terms of the type of supplier who directly provides more than one-half of the requirements of particular organizations [6] are useful in examining these groups of suppliers. Thus, for example, the term "Small-scale loggers market type" describes the procurement set-ups relied upon by mining organizations that obtain more than 50 percent of their mine-timber requirements directly from farmers and other small-scale loggers. The "commercial logger-sawmill operators market type" and the "timber agents market type" are analogously defined. Characteristics of these market types, as revealed by the field survey, are summarized in table 1 and figure 4.

[6] No special significance is attached to this 50-percent dividing line. It is a matter of convenience and is entirely arbitrary.

Reference to table 1 reveals the following major points:

1. Mining organizations are continually approached by small-scale loggers offering to sell mine timbers at less than current prices. Rejection of these offers is frequent; some organizations decline dozens every month.

2. Price is not allowed to operate freely as a regulator of the quantity of mine timbers obtained. Quotas and outright refusal to deal with some prospective suppliers are also employed as quantity regulators. (Item 1, of course, suggests this.)

3. Direct dealing with small-scale loggers is an alternative available to mining organizations throughout West Virginia. In the major northern West Virginia coal field, however, large quantities of mine timbers are also obtained from timber agents, while in the southern part of the state practically all mining organizations deal directly with commercial logger-sawmill operators.

The importance of small forest holdings in northern West Virginia, a factor not mentioned in table 1, accounts for the importance of timber agents in that section, as well as the success of small-scale loggers in actually selling directly to at least a few large organizations in that part of the state. Farmers, for example, own 46 percent of the total commercial forest land area in 15 counties, surrounding and including the major northern West Virginia coal field, while the comparable figure for 16 counties in the major coal-producing area of southern West Virginia is 21 percent. If the comparison is limited to the counties that actually contain the two major coal fields, the comparable percentages for northern and southern West Virginia are 39 and 13 respectively.[7]

4. Most enduring contacts between particular mining organizations and mine-timber suppliers were initiated during World War II, a period in which mine timbers were obtained only with great difficulty.

5. Mine-timber suppliers differ widely in terms of current economic alternatives. Small-scale loggers, as a group, typically have fewer alternatives to mine-timber pro-

[7]Data in these comparisons of northern and southern West Virginia were calculated from the 1950 Census of Agriculture, Parts 13-15, pp. 376-379 and 431-435.

Table 1.--Characteristics of mine-timber market types

Item	Market types		
	Small-scale loggers	Commercial logger-sawmill operators	Timber agents
		GENERAL CHARACTERISTICS	
1. Physical functions performed by individual or organization dealing directly with mining organization.	All functions in conversion of standing timber into delivered mine timbers.	In most cases, all functions in conversion of standing timber into delivered mine timbers. Purchase of logs from farmers and other small-scale loggers.	Primarily transaction arranging (brokerage). Also trucking in a few cases. Concentration-yard operation (storage, sorting, etc.) in a still smaller number of cases.
2. Number of suppliers directly dealt with by mining organization.	Numerous: 10 or 15 to as many as 40 in some exceptional cases.	Frequently 1 or 2 with a maximum of 4 or 5.	One or, in a few cases, two.
3. Use of quotas in dealing with present suppliers (as opposed to taking quantity freely offered at current price).		Quotas used for all market types.	
4. Contacts with prospective suppliers other than those now dealt with.	Mining organizations are continually approached by small-scale loggers offering to sell mine-timbers at less than current prices. Purchasing agents commonly decline a dozen or more such offers in a month's time.		
5. Area where important.	Primarily northern West Virginia.	Southern West Virginia.	Northern West Virginia.
6. Types of mining organizations.	Very small mines throughout the state, and a few large organizations in major northern West Virginia coal field.	Wide range of sizes, but notably nearly every large organization is in southern section.	Wide range of sizes, but notably most large organizations are in northern section.
7. Ownership of land from which mine timbers are cut.	Farmers and other small landowners (in many cases the small-scale logger is also the owner).	Large landowners, both mining organizations to which mine timbers are supplied and other land-holding corporations (railroads, natural gas companies, etc.).	Principally farmers and other small landowners.
8. Proportion of total West Virginia coal production (underground mining) by mining organizations employing this market type.1/	7 percent	71 percent.	22 percent.
		CHARACTERISTICS OF SUPPLIERS DEALING DIRECTLY WITH MINING ORGANIZATIONS	
9. Economic alternatives.	Principally farming (of an unsuccessful sort) plus "odd jobs." Large expansions in Industrial employment, such as occurred during World War II, attract many from this group to employment elsewhere.	Production of other forest products, notably lumber for non-mine uses.	Sawmill operation,2/ dealerships in farming, logging, hauling equipment.
10. Estimate of financial status.3/	Extreme financial insecurity in many cases. Frequently a hand-to-mouth, day-to-day existence.	Wide range, smaller ones rather insecure; larger ones prosperous.	Prosperous.
11. Mine-timber inventory maintained.	One month's supply.	Two to three weeks' supply.	One to three weeks' supply.

(continued)

Table 1. (continued)

Item	Market types		
	Small-scale loggers	Commercial logger-sawmill operators	Timber agents
	RELATIONSHIPS BETWEEN MINING ORGANIZATIONS AND SUPPLIERS		
12. Length of period particular mining organizations and suppliers have dealt with each other.	Wide range: from less than 1 year to 12 or 15 years. Dealings frequently discontinuous.	Frequently 10 or 12 years.	
13. Circumstances under which dealings between particular mining organizations and suppliers were begun.	No consistent pattern.	In many cases dealings were begun during World War II, a time of great difficulty in obtaining mine timbers.	
14. Length of time elapsing between order and delivery.	Three or four days to a week.	Two or three days.	Frequently "order one day, delivery the next."
15. Method of payment.	Cash on delivery for those requesting it, 30-day invoice for others.	Thirty-day invoice.	Agent pays processors cash on delivery; mining organization pays agent on 30-day invoice.
	APPRAISAL OF MARKET TYPE		
16. Estimate of effectiveness in terms of inter-product allocation of timber.4/	Poor because mine timbers are usually the only forest products produced.	Probably better than other market types because the processors produce alternative forest products.	Poor because of great pull toward mine timbers exerted by agents' widespread contacts, and rapid payment.

1/Estimated by: (a) Distributing coal production for each sampling strata among identified market types in the proportions found in sample drawn from that strata (strata delimited by market type believed to be employed by particular mining organizations on the bases of advance information). (b) Aggregating these sampling-strata figures for each identified market type to give coal production by mining organizations employing each type. (c) Dividing total West Virginia coal production into these figures on coal production by market type to give the percentages shown.

2/Sawmill operation and mine-timber brokerage by timber agents are distinct and separate activities, joined together, in most cases, only through being alternative uses of the agent's time in a supervisory capacity. Not joint products in the sense that lumber and mine timbers produced in a sawmill are.

3/No direct measure; estimated from condition of equipment, buildings, etc.

4/No direct measure; estimated from analysis of other characteristics of market types.

duction than do either commercial logger-sawmill operators or timber agents.

6. Periods of greatly expanded industrial production provide additional alternatives to producers in the form of industrial employment elsewhere. These opportunities seem particularly attractive to small-scale loggers. The World War II exodus of numerous West Virginians to Detroit, Cleveland, Pittsburgh, and other industrial centers was a striking example of this situation.

ANALYSIS OF MINE-TIMBER MARKETS

The market analysis in this section is an attempt at formulating a logical, coherent explanation of the observed characteristics of West Virginia mine-timber markets. This is done in three steps. First, the characteristics of the simplest type of market are described. Second, departures of mine-timber markets from this simple type of market are noted. In doing this, mine-timber demand and mine-timber supply are treated separately. Third, demand and supply are fitted together.

CHARACTERISTICS OF A SIMPLE MARKET

Figure 5 depicts the principal features of a relatively simple market. The demand curve shows the quantities of the good in question that buyers would take at alternative prices for that good with everything else (prices of other goods, preferences of buyers as between goods, etc.) held constant. The supply curve in a similar way shows the relationship between the price of the good in question and the quantities that suppliers will make available.[8] The forces of competition between buyers and sellers cause price and quantity to move toward an equilibrium at the intersection of the demand and supply curves. In figure 5 this equilibrium occurs at A when quantity OC changes hands at price OB.

Some assumptions underlying this simple market situation are pertinent to our analysis:

1. Both demand and supply curves are stable. Thus shifts in the curves are rather infrequent and adjustments are most commonly in the form of movement <u>along</u> the curves.

2. Demand in one period is not directly or consciously affected by expected or intended demand in any other period. That is to say, demand, as depicted by a demand curve, is an instantaneous concept: the curve shows the quantities demanded at alternative prices <u>at a particular time</u>, everything else held constant.

3. The quantity demanded at a relatively low price is appreciably larger than the quantity demanded at a rela-

[8] Admittedly the assumption that 'everything else is held constant' is seldom fulfilled over any significant time period in actual market situations. Nevertheless, this is a useful analytical device for abstracting an important part of the problem for detailed analysis.

tively high price, everything else held constant.

4. Supply curves are based upon the costs of producing different quantities of the good in question.

5. Supply curves slope upward as quantity increases. In other words, a progressively higher price must be paid as the quantity of the good changing hands increases. This is usually thought of as resulting from the individual supplier's increasing marginal costs of production and from differences between individual suppliers in terms of their costs of production. In connection with these differences between suppliers, it is assumed that the most efficient producers are employed first, with progressively less efficient ones being attracted into production as a means of expanding quantity.

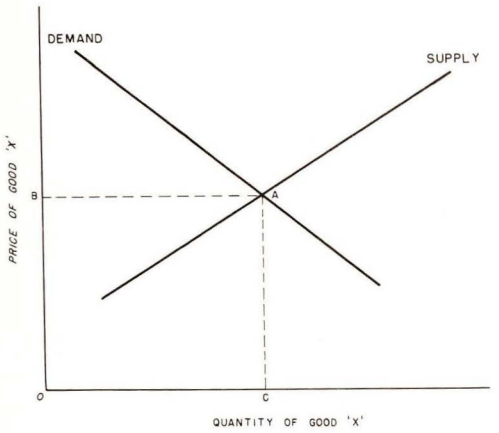


FIGURE 5.--A simple market situation.

6. Equilibrium occurs where the demand and supply curves intersect. Economic forces are continually operating to push price and quantity toward this equilibrium position.

CHARACTERISTICS OF MINE-TIMBER DEMAND

Mine-timber demand in West Virginia departs from the stated assumptions in that it is not stable and the quantity of mine timbers demanded does not vary significantly with changes in mine-timber price.

Some facts of mine-timber utilization and demand are helpful as background for discussing these departures:

1. Demand for mine timbers stems from demand for coal.

2. Outlays for mine timbers account for only a small part of the total cost of mining coal. The president of one mining organization, for example, told the writer that in 1953 they amounted to 3.1 percent of his organization's total mining costs.

3. Mining methods that employ roof-bolting[9] require considerably less timber in mining any given amount of coal than does conventional timbering. No quantitative data illustrating this can be cited, but mining officials universally mention it, and the nature of the roof-bolting technique itself suggests this difference between mining methods.

4. For the individual organization employing a particular mining method, the quantity of mine timber purchased varies directly with the amount of coal mined. Causal factors here are purely technical matters (mining engineering), legal and union-contract safety requirements, and the small mine-timber inventories carried by nearly all mining organizations. The purely technical matters and safety requirements result in a direct relationship between quantity of mine timbers used and amount of coal mined. Maintenance of very small inventories--a month's supply at most and frequently less than this (table 1, item 11)--converts this into a direct relationship between quantity of mine timbers purchased and amount of coal mined. Carrying small inventories stems from the

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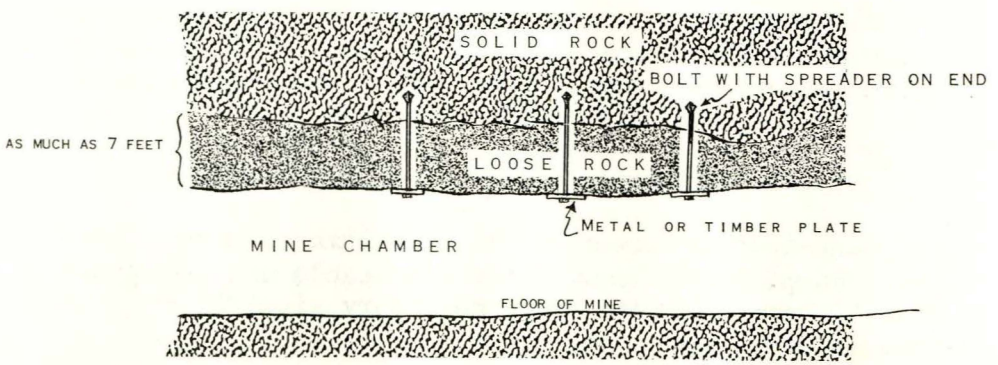
[9]Roof-bolting, a recent technological innovation, is a method of supporting loose overhead rocks by fastening them to solid rock with bolts rather than by supporting them from below with timbers. The essence of this method is shown



in the sketch. The bolt is placed in a hole drilled just large enough to receive it, but too small to permit its removal when the spreader on the end is anchored in the solid rock.

bulky, space-requiring, deterioration-threatened nature of mine timbers on the one hand and the ability of mining organizations to obtain them on short notice, on the other.

5. Changes in mine-timber prices, within the relevant range, have little effect upon decisions concerning changes in mining methods, the amount of coal mined by the individual organization, and the number of organizations mining coal. The fact that mine-timber outlays are only a small part of total mining costs goes far in explaining the greater importance of other factors. Introduction of modern mining machinery that requires additional working space appears to be a major motivation behind adoption of roof-bolting, while casual observation suggests changes in labor cost and changes in the price of coal as the major determinants of the number of active mining organizations and of coal production by individual organizations.

Thus mine-timber demand is neither stable nor responsive to changes in price because the quantity purchased is almost entirely determined by the amount of coal mined and the mining methods employed, neither of which is greatly influenced by mine-timber price.

A simplified picture of mine-timber demand, ignoring all but the most important factors, can be most readily constructed in two steps. The first step is to consider the relationship between quantity of mine timbers purchased (QMT) and the amount of coal mined (Qc), with mine-timber price held constant for analytical purposes. While the quantitative details are unknown, there is a direct relationship between quantity of coal and quantity of mine timbers for each alternative mining method. Figure 6 illustrates this, assuming, for purposes of exposition, that these relationships are linear.

The second step is to consider the relationship between mine-timber price (PMT) and the quantity of mine timbers purchased (QMT), with mining method held constant (fig. 7). The several demand curves and their nearly-vertical positions illustrate the fact that the quantity of mine timbers purchased varies only slightly with price changes but responds greatly to changes in the quantity of coal mined. In other words, there is a whole family of mine-timber demand curves, each curve showing quantity purchased unresponsive to price changes and each curve corresponding to a particular level of coal production.

Figure 8 combines these steps and simultaneously re-

lates mine-timber price (PMT), quantity of mine timbers purchased (QMT), amount of coal mined (Qc), and mining method.

CHARACTERISTICS OF MINE-TIMBER SUPPLY

The simple market situation illustrated in figure 5 assumes that the supply curve is stable and that the quantities of a good supplied at each of a series of prices depend upon the actual costs of producing these quantities. In this way, increasing marginal costs of production cause an upward-sloping supply curve. Mine-timber supply, however, departs from these assumptions in two ways. In the first place, economic opportunities foregone by producing mine timbers ("opportunity cost" in economic terminology), rather than actual production costs, are the major cause of rising prices as the quantity produced increases. Secondly, the supply curve is subject to rather drastic shifts.

Predominance of opportunity cost as a determinant of supply is evidenced by the fact that small-scale loggers, the suppliers with the poorest economic alternatives, consistently offer mine timbers at prices below those paid to other types of suppliers; and at the same time they have the poorest equipment and hence very likely the highest actual costs of production. This implies that if price were allowed to function freely as a regulator of quantity, mine timbers

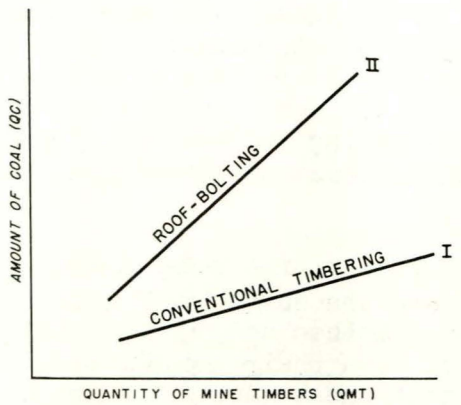


FIGURE 6.--Relationship between the quantity of mine timbers demanded and the amount of coal mined, price of mine timbers held constant.

would first be obtained from small-scale loggers, with commercial logger-sawmill operators and timber agents being attracted into mine-timber production only as prices rise. Furthermore, once a small-scale logger has begun mine-timber production, the quantity he produces is not likely to be influenced greatly by price changes within the relevant

range because increasing his production does not really involve foregoing alternatives to any significant extent.

Commercial logger-sawmill operators and timber agents, on the other hand, can be induced to expand their mine-timber production ("handling" in the case of agents) only through price increases, since expansion necessitates contracting output in other lines of activity (fig. 9). Figure 10 illustrates the effect of differences in economic alter-

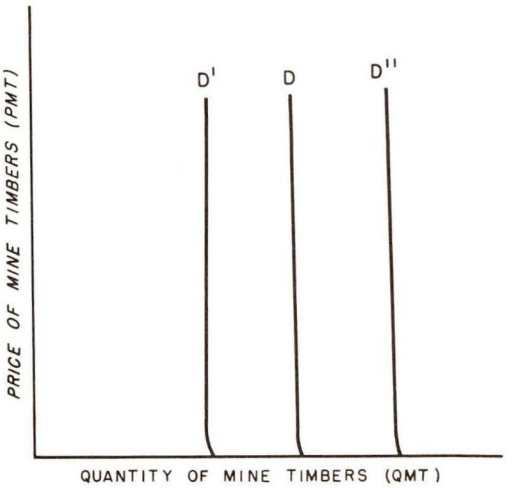


FIGURE 7.--Relationship between price of mine timbers and quantity of mine timbers demanded, method of mining held constant.

natives on the quantities of mine timbers that individual suppliers will make available at alternative prices[10] and shows how these individual supply curves can then be aggregated to form an industry or market supply curve.[11]

The supply curve that affects mining organizations in particular locations is, however, only a part of this total industry supply curve, for distance eliminates some suppliers at any relevant price. Hence mine-timber suppliers in northern West Virginia are chiefly small-scale loggers and timber agents, while in the southern part of the state small-scale loggers and commercial logger-sawmill operators predominate (table 1, item 6).

So much for the present situation. An important pos-

[10]Obviously the three situations shown are but a very few examples drawn from many possibilities.

[11]Graphically, this is a process of adding quantities for each point on the price axis.

sible departure is the complete withdrawal of many small-scale loggers from the mine-timber industry during periods of greatly expanded industrial activity. In that event, individual supply curves such as A (in fig. 10) disappear completely and the industry supply curve moves to the left. This movement amounts to obtaining a smaller quantity at each alternative price, or conversely, having to pay a higher price for each alternative quantity.

INTEGRATION OF DEMAND & SUPPLY

Demand and supply do not, of course, operate apart from each other. They must be integrated so one can see how mine-timber markets actually operate. This can be done most readily by first viewing the marketing process from the viewpoint of the individual mining organization, and then expanding the view to include the entire mining industry.

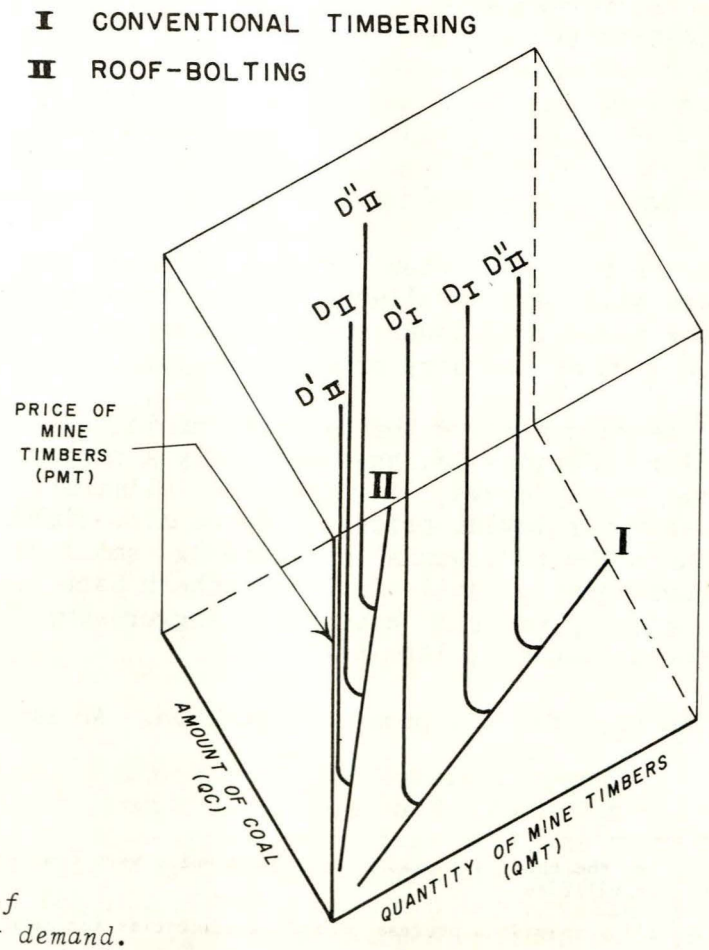


FIGURE 8
A picture of mine-timber demand.

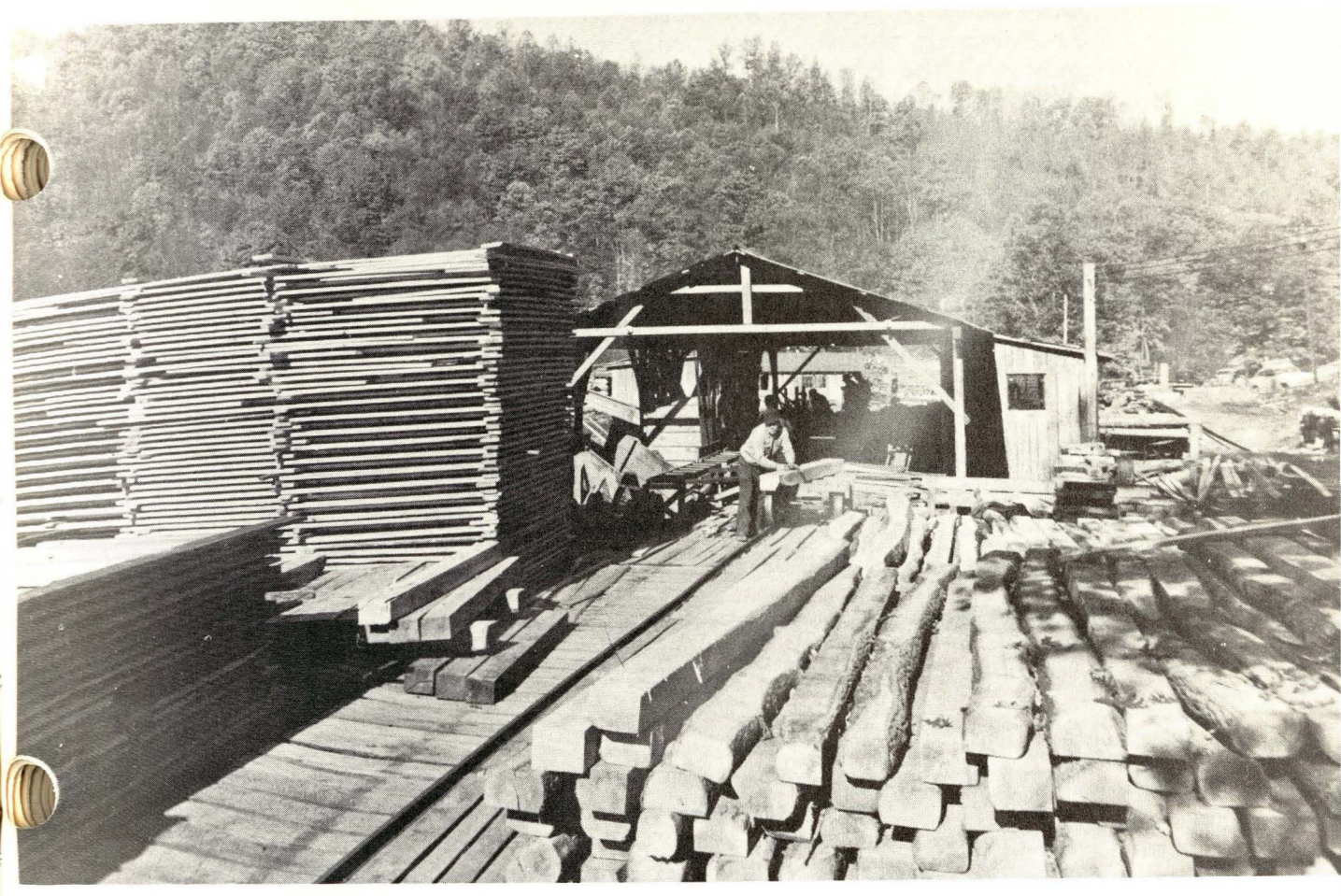


FIGURE 9.--Commercial sawmills can produce a variety of other timber products besides mine timbers.

Mine-timber demand by the individual mining organization may be represented by a single nearly-vertical demand curve if attention is restricted to a particular mining method and a particular level of coal production at a given time. The nearly vertical position of the demand curve shows that under these circumstances of instantaneous demand the quantity of mine timbers purchased is not responsive to price changes. The market equilibrium would be at the intersection of the appropriate demand curve and the supply curve that faces the mining organization. In figure 11 this occurs at A, and the resulting price and quantity are OB and OC respectively.

Mine-timber demand is not instantaneous, however. Mining organizations attempt to maintain procurement set-ups capable of meeting maximum foreseeable requirements. In

most cases, they do not seem to consider satisfactory any procurement set-ups that rely wholly upon small-scale loggers. The basis of this belief is unavailability of this type of supplier in periods of greatly expanded industrial activity--the very times when coal demand and mine-timber demand are also expanded. Nearly all mining organizations make some attempt to keep more reliable suppliers in the market. To accomplish this, price is set at the level be-

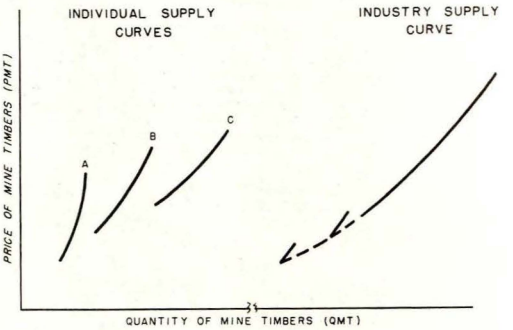


FIGURE 10.--Derivation of industry supply curve by aggregation of individual firm supply curves.

lieved necessary to attract the type of supplier wanted. Quantity is then restricted to that desired by quotas and by outright refusal to deal with some potential suppliers. In this way a part of the supply available at the established price is refused and the desired quantity is obtained from the type of supplier with which the mining organization wishes to deal. Thus timber agents and commercial logger-sawmill operators are deliberately encouraged to enter and remain in mine-timber markets to which they might not be attracted were price allowed to function freely as a regulator of quantity.

Figure 11 depicts the process of obtaining the desired quantity from the desired type of supplier. OJ is the price believed necessary to attract him. GE is the desired quantity (exactly equal to OC if quantity demanded is completely unresponsive to changes in price). IH is the segment of the supply curve that is made ineffective by quotas and other restrictions.

One must recognize that mining organizations differ in their expectations of the future if he would view the marketing process as including the entire West Virginia coal industry. Some mining organizations are content to get their mine timbers from the most reliable small-scale loggers available, while others want to eliminate small-scale log-

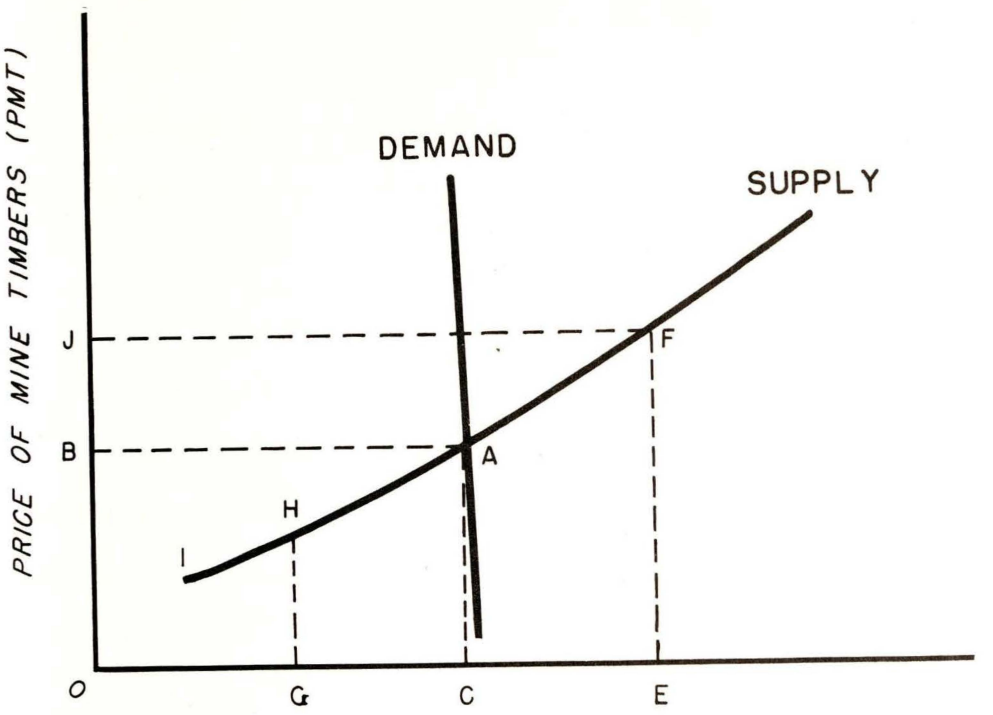


FIGURE 11.--A picture of mine-timber markets in operation.

gers entirely, and still others are somewhere between these two extremes. These differences between mining organizations encourage the simultaneous existence of several prices for identical items (adjusted to eliminate the effects of transportation cost). Imperfect knowledge of the market, particularly on the part of sellers, also contributes to this multi-price situation.

CONCLUSIONS

The following conclusions are, for the most part, answers to questions posed in the Introduction.

The West Virginia coal industry experiences no present difficulty in obtaining mine timbers. Its repeated refusals to deal with many prospective suppliers make this clear. These refusals also underline the minor importance attached to minimization of present mine-timber costs. Mine-timber procurement policies stem from a desire to assure stability of supply and to maintain procurement set-ups that are adequate to meet maximum foreseeable requirements. Continued purchasing from relatively large-scale suppliers re-

sults, even though small-scale loggers repeatedly offer mine timbers at less than prevailing prices.

The major advantages of present mine-timber marketing arrangements are stability of present supplies and assurance of future supplies, despite the fact that a large number of suppliers are likely to disappear from the mine-timber industry with any large-scale expansion of industrial activity. The major benefit accrues to coal-mining organizations. This is not surprising, since the initiative in establishing these procurement set-ups rests with the mining organizations.

Elimination of "middlemen," notably timber agents, is not at all likely to succeed as a means of increasing returns to forest landowners. Were it possible to eliminate them--a doubtful matter in itself--mining organizations would take steps to encourage their reentrance into the market as a means of assuring future supplies.

Mine-timber markets are exceedingly effective in the sense of being able to rapidly fill orders placed by mining organizations. Close contacts and rapid payment interact with "a-bird-in-the-hand-is-worth-two-in-the-bush" philosophy on the part of many suppliers, particularly the smaller ones, to bring about this result. A marked scarcity of economic opportunities is the fundamental cause of this philosophy. Further, the highly organized nature of mine-timber procurement suggests that use of high-quality timber in West Virginia coal mines may result largely from a contrasting lack of organization in the procurement of other forest products.

Effects of differences in degree of market organization are heightened by the fact that West Virginia timber-product markets are, in many cases, one-product markets. Forces of competition are often ineffective in channeling timber into the economically more desirable use because mine timber markets, standard lumber markets, commercial veneer markets, and the like come to a common focus in only a few points. The operations of commercial logger-sawmill operators, for example, are the only direct contact between mine-timber markets and these markets for other forest products.

The underlying importance of unemployment and underemployment as sources of timber-marketing and forest-management problems in West Virginia cannot be overemphasized. This observation is certainly not original with this study. Nevertheless it is indispensable to an understanding of mine-timber marketing, as well as a wide variety of other problems, in that state.